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ARM MOTION ASSEMBLY FOR EXERCISE DEVICE

FIELD OF THE INVENTION

This invention relates generally to exercise devices. More specifically, the invention relates to an assembly which may be incorporated into a variety of exercise devices and which provides a natural arm motion.

BACKGROUND OF THE INVENTION

In order to provide exercise to muscle groups in the upper and lower body, many types of exercise devices, including elliptical devices, treadmills, stair steppers, stationary bicycles, ski simulators and the like, provide for motion of a user's arms during exercise. For example, the elliptical exercise devices shown in U.S. Patents 5,242,343; 5,383,829; 5,577,985; 5,562,574 and 6,398,695 include members and linkages which allow a user's arms to move back and forth during exercise. Some other exercise devices which provide for arm motion are shown in U.S. Patents 4,949,954; 2,603,486; 4,869,494; 5,653,662; 5,913,751; 5,993,359; 5,836,855; 5,788,610; 6,024,676; 6,017,295; 6,017,294; 5,957,814; 5,947,872; 5,916,064; 5,823,919 and 5,921,894.

While a number of exercise devices, and in particular certain elliptical exercise devices, provide a natural range of motion for a user's lower body muscles which simulates a natural running and stepping action, the present invention recognizes that the arm and shoulder motion provided by heretofore available exercise equipment does not simulate a natural upper body motion. Referring now to Figure 1, there is shown a schematic depiction of a person

participating in a machine-assisted exercise. As shown in Figure 1, the person 10 is using an exercise device, which in this instance is represented by the block 12. It is to be understood that this block 12 is meant to represent any generic exercise device such as a treadmill, elliptical device, stair stepper, stationary cycle, ski simulator or the like. Arrow A traces the path of motion of a user's arm which is achieved through the use of conventional exercise equipment of the type referred to hereinabove. As will be noted, the user's hand travels along a path of motion, A, which is generally horizontal. This path of motion A causes the user's arm to pivot primarily at the elbow, and may also cause some small degree of pivoting at the shoulder joint. Analysis of this motion demonstrates that it is not equivalent to the arm motion which a person's body undergoes when he or she is participating in unassisted aerobic exercise such as running, jogging or walking at a brisk pace. In such instance, the person's hand traverses a path as shown by arrow B. This preferred path of travel is curved and generally inclined relative to the horizontal. It produces a hand and arm movement in which pivoting of the arm occurs primarily at the shoulder joint. An arm action of this type produces a more productive and beneficial aerobic workout and lessens the chance of muscle fatigue or joint trauma. As a consequence, exercise which incorporates this type of arm motion is generally more comfortable for the user, which assures better compliance with an exercise program.

As will be detailed hereinbelow, the present invention provides an arm motion assembly for an exercise device. The arm motion assembly of the

present invention provides a very natural arm motion in which a user's arm pivots about the shoulder joint. The assembly of the present invention may be readily implemented in a variety of configurations and is readily adapted to various exercise devices.

SUMMARY OF THE INVENTION

There is disclosed herein an arm motion assembly for an exercise device. The assembly includes a first link which is pivotally supported by a first frame portion of the exercise device at a first pivot point so that the first link is capable of reciprocal motion about the first pivot point. The assembly includes a second link having a handgrip portion. The second link is pivotally supported by a second frame portion of the exercise device at a second pivot point spaced from the first pivot point. The assembly further includes a connector link which extends between the first link and the second link. The connector link is pivotally joined to the first link at a first junction point and to the second link at a second junction point. In one embodiment, the connector link has a handgrip associated therewith; and, when the first and second links pivot about their respective pivot points, the handgrip travels in a reciprocal path.

In another embodiment, the first link is a swing arm and the second link is an arm link having a handgrip portion associated therewith. When the swing arm of this embodiment reciprocates about the first pivot point, the connector link causes the arm link to pivot about the second pivot point so that the handgrip travels in a reciprocal path of travel.

In certain embodiments, the locations of the junction points and pivot points may be made adjustable relative to other portions of the assembly so as to allow a user to control the degree and orientation of the arm motion achieved thereby.

Also disclosed is a specific embodiment of the present invention which is utilized in conjunction with an elliptical exercise device. This device includes a frame having a first pivot axis defined thereupon, a foot link having a foot receiving portion which is configured to support a user's foot, a coupler for coupling a first end of the foot link to the first pivot axis so that the first end of the foot link is directed to travel in an arcuate path, and a guide which is operable to direct the second end of the foot link in a reciprocal path of travel as the first end travels in the arcuate path. This embodiment further includes a first link which is pivotally supported by the frame at a first pivot point defined on the frame, and a second link pivotally supported by the frame at a second pivot point defined on the frame and spaced apart from the first pivot point. The assembly further includes a connector link which extends between the first and second links. The connector link includes a handgrip portion, and is pivotally joined to the first link at a first junction point and to the second link at a second junction point so that when the first link reciprocates about the first pivot axis the connector link causes the second link to pivot about the second pivot axis so as to cause the handgrip to move in a reciprocal path of travel. In specific embodiments of this exercise device, the guide comprises a ramp. In other embodiments, the guide comprises a portion of the swing arm.

Also disclosed is another embodiment of elliptical exercise device in which the first link is a swing arm and the second link is an arm link and has a handgrip portion associated therewith. In this embodiment, the swing arm reciprocates about the first pivot point and causes the connector link to reciprocate the arm link about the second pivot point, so that the handgrip travels in a reciprocal path.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic depiction showing the arm motion achieved by prior art exercise devices as compared with the arm motion achieved by the assembly of the present invention;

Figure 2 shows an elliptical exercise device which incorporates one embodiment of arm motion assembly of the present invention;

Figure 3 is an enlarged fragmentary view of a portion of the arm motion assembly of Figure 2;

Figure 4 is a partial fragmentary view of another embodiment of arm motion assembly in accord with the present invention;

Figure 5 is a fragmentary view of a portion of yet another arm motion assembly of the present invention;

Figure 6 shows another elliptical exercise device which incorporates an arm motion assembly of the present invention;

Figures 7A-7C depict the arm motion assembly of the Figure 6 embodiment shown at three different positions in its operational cycle;

Figure 8 depicts another embodiment of the present invention as incorporated in a treadmill; and

Figure 9 is a top view of a person demonstrating a variant of the arm motion achieved through the use of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Figure 2 shows one embodiment of the arm motion assembly of the present invention as incorporated into an elliptical exercise device. However, it is to be understood that the arm motion assemblies of the present invention are not limited to devices of this type, and may be readily incorporated into other types of exercise equipment which include by way of illustration and not limitation, treadmills, stair steppers, ski simulators, stationary and mobile cycles, and the like.

As is shown in Figure 2, the elliptical exercise device 14, which incorporates the assembly of the present invention, includes a first and a second foot link 16a, 16b which are configured to support a user's foot thereupon. The device 14 includes a frame, and for clarity of illustration, the frame is shown in cutaway form with only portions 24a, 24b and 24c depicted. The frame has a first pivot axis 18 defined thereupon, and as is shown in the prior art, for example in U.S. Patents 5,242,343 and 5,383,829, the disclosures of which are incorporated herein by reference, a first end of each foot link 16a, 16b is coupled to this pivot axis 18 by a coupling member 20a, 20b so that the first end can move in an arcuate path. As illustrated, the coupling members are crank arms and the arcuate path is a circular path which encompasses the pivot

axis 18; however, it is to be understood that in other embodiments of elliptical exercise device, the arcuate path may not be a circular path as long as it is a closed path which is at least partially curved. The arcuate path need not encompass the pivot axis. As is known in the art of elliptical exercise devices, a second end of each foot link 16a, 16b is directed in a reciprocal path of travel by a guide member which may comprise a ramp, a swing arm, or a support surface, such as a floor on which the exercise device is located. As is known in the art, this combination of reciprocal and arcuate motion provides for a generally elliptical path of travel for the user's foot, and this path of travel simulates a natural running and stepping motion wherein when the user's foot travels forward, the heel portion thereof initially rises at a faster rate than the toe portion; and when the user's foot travels rearward, the heel portion thereof initially falls at a faster rate than does the toe portion. In the Figure 2 embodiment, the second ends of the foot links 16a, 16b are guided on the reciprocal path by a first set of links which comprise swing arms 22a, 22b respectively. These swing arms are supported by a portion of the frame 24b at a first pivot point 26 defined thereupon.

The assembly further includes a set of second links; and, in the illustrated embodiment, these second links comprise arm links 28a and 28b which are also pivotally supported upon a second portion of the frame structure 24c at a second pivot point 30 defined thereupon. The first 26 and second 30 pivot points are spaced apart on the frame, and may be defined by axles, pins, bearings, journals and other equivalent mechanical structures. As illustrated,

each arm link 28a, 28b includes a handgrip portion 28a', 28b', and in this embodiment, the handgrip portions 28a', 28b' are angularly disposed relative to the remainder of their respective arm links. Each arm link 28 is coupled to a respective swing arm 22 by a connector link, and in this drawing only the connector link 32 which joins the first swing arm 22a and the first arm link 28a is visible.

When the device 14 of Figure 2 is in operation, the reciprocal motion of a second end of a foot link 16 causes its associated swing arm 22 to reciprocate about a first pivot point 26 causing a corresponding reciprocal motion of a control link 32 which in turn causes the associated arm link 28 to pivot about its pivot point 30. This motion of the arm link provides a natural arm motion for a user who is gripping the handle portion of the arm link.

Referring now to Figure 3, there is shown an enlarged view of a portion of the exercise device 14 of Figure 2 specifically illustrating the arm motion assembly of the present invention. For clarity of illustration only, that portion of the assembly which provides motion to one arm of the user is shown, and it is to be understood that in general most installations will include a corresponding assembly so as to provide motion to both of the user's arms.

As is shown in Figure 3, a swing arm 22 is pivotally supported by a portion of the exercise device's frame 24b at a first pivot point 26. A connector link 32 is pivotally connected to the swing arm 22 at a first junction point 34. This connector link 32 is pivotally joined to an arm link 28 at a

second junction point 36. The arm link 28 is supported by another portion of the frame 24c at a second pivot point 30 as previously described.

In the Figure 3 embodiment, the swing arm 22 includes a rocker arm portion 22' which projects therefrom at an angle. The swing arm is supported at the first pivot point 26 at the vertex of this angle. As will be seen, the connector link 32 is joined to the rocker arm portion 22' of the swing arm 22. As is further illustrated, the location of this first junction point 34 may be adjustable, and in that regard, the connector link 32 and/or swing arm 22 may include a number of holes or other connector points predisposed therein. Likewise, the location of the second junction point 36 may be made adjustable, and in this regard, either the connector link or arm link 28 may include predrilled holes or the like therein. By adjustment of the junction points 34, 36, the arm motion may be regulated.

Yet other embodiments of the assembly of Figure 2 may be implemented in accord with the present invention. For example, Figure 4 shows an arm motion assembly generally similar to that of Figures 2 and 3; however, the swing arm 42 does not include any rocker arm portion. Instead, the connector link 32 joins directly to the length of the swing arm 42 at a junction point 34. As is shown, this first junction point 34 is inboard of the first pivot point 26; however, in other embodiments, the swing arm 42 may be connected to the frame portion 24b at a first pivot point which is inboard of the free end of the swing arm 42, and the control link may be connected to the swing arm 42 at a junction point 34 which is outboard of the pivot point 26,

and in this instance, the free end will project above the pivot point. In the Figure 4 embodiment, the arm link 48 includes a handle portion 48' which is pivotally connected to the remainder of the arm link 48. This pivotal connection allows for greater freedom of motion of the user's wrist. As is also shown in Figure 4, the arm link 48 includes a length adjuster section 50. This section may comprise a lockable telescoping portion of the arm link 48, a screw adjustable portion or the like. This length adjustment feature allows the length of the arm link 48 to be increased or decreased to accommodate different user preferences. Similar adjustment features may be incorporated into the other links.

Referring now to Figure 5, there is shown a fragmentary view of yet another embodiment of arm motion assembly structured in accord with the principles of the present invention. As is shown in Figure 5, the arm motion assembly includes a swing arm 52 having a rocker arm portion 52' projecting therefrom. In this regard, the swing arm 52 of Figure 5 is generally similar to the swing arm 22 of Figure 3. However, in the Figure 3 embodiment, the swing arm 22 is joined to the frame 24b at a first connection point 26 which is near the vertex of the angle formed by the rocker arm portion 22' and the remainder of the swing arm 22. In the Figure 5 embodiment, the rocker arm portion 52' of the swing arm 52 projects therefrom at a point between the ends of the remainder of the swing arm 52. In this regard, the first pivot point 26 is spaced from the vertex of the angle formed by the rocker arm portion 52' and remainder of the swing arm 52. It will be understood that yet other

embodiments will be readily apparent to one of skill in the art in view of the general teaching given herein.

Referring now to Figure 6, there is shown another embodiment of elliptical exercise device 60 which incorporates an arm motion assembly of the present invention therein. This device 60 shares similar elements with the device of Figure 2, and such elements will be referred to by like reference numerals. The device 60 of Figure 6 includes a first and a second foot link 16a, 16b which have a first end thereof coupled to a pivot axis 18 by coupling members 20a and 20b which comprise crank arms. As in the previous embodiment, these coupling members 20a, 20b are supported at the pivot point by a portion of the frame 24a of the exercise device, and for clarity of illustration, this frame is shown in cutaway view. The second ends of each of the foot links 16a, 16b are supported by and guided along a reciprocal path of travel by a pair of swing arms 62a, 62b which comprise the first links of the arm motion assembly of the Figure 6 embodiment. These swing arms 62a, 62b are affixed to a frame portion 24b of the device 60 at a first pivot point 66, as generally described above. The assembly further includes a second link 68a, 68b which functions as a control link and is supported by the frame 24b at a second pivot point 70.

The assembly of Figure 6 further includes connector links 72a, 72b which join the first arm links 62 to their respective second links 68. In that regard, each connector link 72 is joined to its respective swing arm 62 at a first junction point 74a, 74b respectively, and to its respective second link 68 at a

second junction point 76a, 76b. Each connector link 72 has a handle portion 78a, 78b associated therewith. As illustrated in Figure 6, the handle portions 78 are integral with the remainder of the connector link 72; however, the handle portions may be made to be detachable. Also, they may be movable relative to the connector link and/or they may be otherwise disposed on the connector link. Also, as in the previous embodiment, the positions of the pivot points and attachment points may be made adjustable relative to the frame and/or linkages. Also, the exercise device may employ rails, ramps or other such structures to guide the second ends of the foot links in a reciprocal path of travel.

Referring now to Figures 7A-7C, there is shown an enlarged detail of the arm motion assembly of the Figure 6 embodiment. For clarity of illustration, only the first link 62, second link 68 and connector link 72 of the assembly, and a portion of the frame 24b is shown.

As will be seen in the figures, the connector link 72 is attached to the second link 68 through a rocker arm portion 72′ projecting therefrom. In other embodiments of the invention, the rocker arm 72′ may be dispensed with. Also, as is illustrated, the handgrip portion 78 of the connector link 72 is shown as being linearly aligned with the main axis of the connector link. In other embodiments, the handle portion 78 may be inclined relative to the remainder of the link; and as noted above, the handle portion may be pivotable, removable or otherwise configured.

It should also be noted that in the Figures 7A-7C illustrations, the first link 66 is shown partly cut away insofar as the lower portion thereof is not depicted. It is to be understood that in other embodiments of the invention which do not employ swing arms, the assembly of Figures 7A-7C may be configured so that the first link 66 terminates shortly beyond the first pivot point 66. This will provide an arm motion assembly which is relatively compact and which may be utilized in conjunction with a variety of exercise devices such as treadmills, stair steppers and the like. In various embodiments, the assembly may be mechanically coupled to the remainder of the exercise device to produce an arm motion which is in synchrony with the exercise device. In other instances, the assembly may be mechanically coupled to the exercise device so as to operate in synchrony therewith.

Figure 7A shows the assembly of Figure 1 in a first position. Figure 6B shows the same assembly in a second use position wherein the two links 62, 68 have pivoted relative to the frame 64 so as to cause a corresponding movement in the connector link 72 and associated handle 78. Figure 6C shows the same assembly 60 in a third position wherein the links 62 and 68 have pivoted to a still further degree. The arrow C in Figure 6C shows the path of travel of the handle portion 78 as the assembly moves from the position shown in Figure 6A to the position shown in Figure 6C. As will be seen, the path of travel is curved in a direction which is generally angled relative to horizontal and as such provides a natural arm motion corresponding to that illustrated in Figure 1.

While the foregoing description has been with primary regard to one specific elliptical exercise device, it is to be understood that this invention may be implemented in connection with variously configured exercise equipment which by way of illustration and not limitation includes other elliptical devices, treadmills, stair steppers, cross trainers, skiing simulators, stationary and mobile cycles, and the like.

Referring now to Figure 8, there is shown another embodiment of an arm motion assembly as implemented in a treadmill device 80. The treadmill 80 is of conventional design insofar as it includes a belt 82 supported by a pair of rollers 84, 86. As is known in the art, the treadmill may be powered by a motor (not shown) or it may be powered solely by the user. The treadmill 80 of Figure 8 includes an arm motion assembly generally similar to that depicted in Figures 6 and 7A-7C. The arm motion assembly includes a set of first links 62a, 62b; a set of second links 68a, 68b; and a set of control links 72a, 72b which are generally as described with reference to Figures 6 and 7A-7C. The first links 62 and the second links 68 are supported on a frame portion 88 of the device 80 at a first pivot point 90 and a second pivot point 92, respectively. As in the previous embodiment, the control links 72a, 72b are joined to their respective first and second links at first junction points 94a, 94b and second junction points 96a, 96b respectively.

In its simplest form, the assembly may merely comprise a first link, a second link and a control link affixed to the frame of the device. In such embodiments, the motion of the two sets of links is not synchronized, or

otherwise joined to, the motion of the remainder of the exercise device. However, as is specifically depicted in the Figure 8 embodiment, the arm motion assembly is configured so that the motion of the two handle portions 78a, 78b of the control links 72a, 72b is linked so that they operate in synchronization. In this regard, each of the first links 62a, 62b is coupled to a synchronization link 98a, 98b, each of which is in turn coupled to a crank arm 100a, 100b which rotates about a pivot axis 102 provided by a portion of the frame 88 of the device 80. The action of the synchronization links 98a, 98b in conjunction with the crank arms 100a, 100b assures that the handle portions 78a, 78b of the connector links 72 operate in synchronization. The crank arms 100a, 100b may be motor driven and/or coupled to the remainder of the treadmill mechanism so that actuation of the arm motion will be accomplished automatically when the belt 82 of the treadmill 80 turns.

In some embodiments, the crank arms 100a, 100b may have a flywheel associated therewith. The presence of a flywheel will smooth out the action of the arm motion assembly. Also, the arm motion assembly may have a resistance device associated therewith, so that the degree of exercise provided by the arm motion assembly can be adjusted independently of the remainder of the apparatus. As is known in the art, such resistance devices include frictional devices which employ belts, pads, calipers and the like, as well as magnetic or electromagnetic braking devices. The resistance device may be associated with the flywheel (if one is present) or with any other portion of the assembly. Use of an independent resistance device and/or a flywheel is particularly desirable

when the arm motion assembly is not mechanically coupled to the remainder of the exercise device so as to move in conjunction therewith.

It will be appreciated by those of skill in the art that linkage assemblies generally similar to those described above may be likewise incorporated into other exercise devices such as stair steppers, ski devices and the like.

Referring now to Figure 9, there is shown a top plan view of a person using an exercise device of the type generally discussed hereinabove (the device is not depicted). In a natural running motion, a user's arms move in a path of travel which is curved with regard to the vertical direction as discussed hereinabove; however, this path of travel is also curved in a horizontal plane as shown in Figure 9. Specifically, curves C_1 and C_2 are vertically curved as is shown, for example in Figure 7C. At the same times, these paths of travel C_1 and C_2 are nonparallel and, in at least some instances, curved in a horizontal direction. The arm motion assemblies of the present invention may be configured so as to provide for such motion. For example, a simple, nonparallel but noncurved motion could be provided by angling the first and second pivot points relative to the longitudinal axis of the exercise device. Likewise, such an angled relationship can be established by employing universal joints, ball joints or the like or affixing the assembly to the frame of the exercise device. Use of universal joints, ball joints or flexible joints such as living hinges can also provide for a horizontally curved path of travel. In other embodiments, an angled and/or curved path of travel can be provided by pivotally joining the handle to its appropriate link.

It is also to be understood that while the assemblies of the present invention are depicted herein as rigid links, it is to be understood that the links may comprise flexible and/or resilient members such as springs, cables, elastomeric materials and the like taken either singly or in combination.

While specific embodiments and configurations of the assembly of the present invention have been illustrated and discussed, yet other embodiments and variations will be readily apparent to one of skill in the art in view of the teaching presented herein. The foregoing drawings, discussion and description are illustrative of specific embodiments of the invention but are not meant to be limitations upon the practice thereof. It is the following claims, including all equivalents, which define the scope of the invention.